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INSTRUCTION MANUAL

REGULATED POWER SUPPLIES

MODEL LXD-3-152

This manual applies to units bearing serial no. prefixes A&B.

MP MASTER
MA28944

LAMBDA

LAMBDA ELECTRONICS MELVILLE, L. I., N. Y.

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This manual provides instructions intended for the operation of Lambda power supplies, and is not to be reproduced without the written consent of Lambda Electronics Corp. All information contained herin applies to the LXD model unless otherwise specified.

LAMBDA ELECTRONICS CORP. MELVILLE, L.I., N.Y.
MAIN PLANT TELEPHONE: 516 MYrtle 4-4200

IM-LXD

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SPECIFICATIONS AND FEATURES

D.C. OUTPUT — ±12 VDC to ±15 VDC regulated for line and load. See table I for current rating at ambient temperature.

TABLE I

AMBIENT TEMPERATURE	40°C	50°C	60°C	71°C
MAX. CURRENT (MA)	400	370	330	300

REGULATED VOLTAGE OUTPUT
(each side)

Regulation . . . . . 0.1% line or load with input variations from 105-132 or 132-105 volts AC and load variations from no load to full load or full load to no load.

Ripple . . . . . 1.5 millivolts rms; 5 millivolts peak to peak.

Temperature Coefficient . . . . . Output change in voltage 0.03%/°C.

A.C. INPUT — 105-132 VAC at 47-440 Hz. Input power: 34 Watts*. Delete 40° C rating for 47-57 Hz input. For 63-440 Hz input, consult factory.

* With output loaded to full current rating and input voltage 132 volts AC, 60 Hz.

TRACKING — Absolute voltage difference between negative and positive outputs within 2 %.

OVERLOAD PROTECTION

Electrical
External . . . . . Automatic electronic current limiting circuit limits output current to a preset limit value for protection of load and power supply when external overloads and direct shorts occur.

INPUT AND OUTPUT CONNECTIONS --- Terminal block on rear of chassis.

OPERATING AMBIENT TEMPERATURE RANGE AND DUTY CYCLE —— Continuous duty from 0°C to 71°C ambient.

STORAGE TEMPERATURE —— -55°C to 85°C (non-operating)

V D C ADJ CONTROL —— Voltage adjust control permits adjustment of DC output.

PHYSICAL DATA

Size	3-3/16" x 3-5/16" x 5"
Weight	3 lbs. net; 3-1/4 lbs. shipping wt.
Finish	Gray, FED. STD. 595 No. 26081

MOUNTING —— Three surfaces, each with tapped mounting holes can be utilized for mounting this unit. The LXD-3-152 power supply can be mounted with Top, Bottom, or Front facing up. Top, Bottom or Front must be in a horizontal plane. Refer to figure 7 for mounting details.

SUFFIX "R" —— LXD-3-152 power supplies with suffix "R" are fungus inert.

"V" OPTION —— The LXD-3-152 power supply can be obtained for 205-265 VAC, 47-440 Hz input or 187-242 VAC, 47-440 Hz input. See nameplate for AC input rating. See Schematic Diagram for rewiring of AC input. At 47-57 Hz delete 40°C rating.

ACCESSORIES

Rack Adapter	Rack adapters LRA-8, LRA-10, LRA-11, LRA-12, and LRA-13 with or without chassis slides are available.
Overvoltage Protector	Externally mounted, Overvoltage Protector LC-OV-11 is available for use with the LXD-3-152 power supply.
Metered and Non-Metered Panels	Metered panels MP-3, MP-5 and Non-Metered panels P-3, P-5 are available for use with Lambda rack adapters LRA-4, LRA-6 or LRA-7.

THEORY OF OPERATION

GENERAL

The text in this section refers to components associated with the plus (+) side of the power supply; however, the discussion is equally applicable to the minus (-) side which has similar components, except for potentiometer R6, which is only used on the (+) side.

The Lambda LXD-3-152 power supply consists of an AC input circuit and transformer; a preregulator*; a main regulator circuit consisting of a rectifier and filter, a series regulator, emitter follower driver, a current comparator*, a voltage comparator*, an amplifier*, current and voltage sensing networks and a voltage reference circuit*.

* This circuit element is part of integrated circuit (IC1) in the supply.

The circuit arrangement is shown in block diagram form, figure 5. The circuitry is discussed with reference to the block diagram and the schematic diagram.

FUNCTIONAL DESCRIPTION

Single phase input power is applied to transformer T1 through the input circuit.

The main rectifier, a full wave bridge rectifier, provides the power which is filtered by capacitor C1 and then regulated via a series regulator and delivered to the output. The main rectifier also provides power for the preregulator located in IC1. The reference element, powered by the preregulator, provides a reference voltage for the voltage comparator.

Constant voltage circuit operation is determined by changes in the load which cause a change in one input to the voltage comparator through voltage dividers R4, R6 and R8. A second input to the comparator is a reference voltage that is developed by the preregulator in IC1. The comparator compares the output voltage change with the reference voltage resulting in an error signal at the output of the comparator.

In constant voltage operation, the voltage across R1 is less than the base-to-emitter voltage of the amplifier in IC1, causing the current comparator to be at cut off. If the load current decreases, causing a rise in output voltage, the voltage comparator conducts more and less current flows into the base of series regulator Q1. This action causes the series regulator impedance to increase and the output voltage to decrease accordingly.

Current limit circuit operation is determined by changes in the load. The current comparator samples load current through current sensing resistor R1. When the voltage drop across R1 increases to the preset reference determined by the base-to-emitter voltage of the amplifier, the current comparator conducts. Thus, when the output current rating of the unit is exceeded, the current comparator conducts, decreasing the current into the base of series regulator Q1, resulting in an increase of voltage across the series regulator and a decrease of output voltage,

effectively limiting the output current to a safe value. The current limit value is determined by fixed resistor R1 and the base-to-emitter voltage of the amplifier.

OPERATING INSTRUCTIONS

BASIC MODE OF OPERATION

This power supply operates as a constant voltage source provided the load current does not exceed the rated value at 40°C. For continuous operation, load current must not exceed the rating for each ambient temperature.

CONNECTIONS FOR OPERATION

NOTE: Make all connections to the unit before applying AC input power.

Ground Connections. The Lambda power supply can be operated either with negative, positive or common terminal grounded. Use insulated wire whenever positive or negative output terminals are connected to terminal 3.

Connection Terminals. Make all connections to the supply at the terminal block on the rear of the supply. Apply input power to terminals 1 and 2; always connect the ungrounded (hot) lead to terminal 1.

The supply positive terminal is brought out to terminal 7. The supply negative terminal is brought out to terminal 5. Recommended wiring of the power supply to the load and selection of wiring is shown in figures 1 through 4. Selection of proper wiring is made on the basis of load requirements. Make all performance checks and measurements of current or voltage at the rear output terminals. Connect measuring devices directly to terminals or use the shortest leads possible.

SUPPLY LOAD CONNECTIONS

Connections For Operation as a Constant Voltage Source

The output impedance and regulation of the power supply at the load may change

when using the supply as a constant voltage source and connecting leads of practical length are used. To minimize the effect of the output leads on these characteristics, remote sensing is used. Recommended types of supply-load connections with local or remote sensing are described in the following paragraphs.

Refer to figure 1 to determine voltage drop for particular cable length, wire size and current conditions. Lead lengths must be measured from supply terminals to load terminals as shown in figure 2.

Local Sensing Connection, Figure 3*. The two-wire connection, with local sensing is the connection suitable for applications with relatively constant load. Any load connection combination, as shown in the figure, can be used.

Remote Sensing Connection, Figure 4*. Remote sensing provides complete compensation for the DC voltage drops in the connecting cables. Sensing leads should be a twisted pair to minimize AC pick-up. A 2.5 mf, elect., capacitor may be required between output terminals and sense terminals to reduce noise pick-up.

*At no time can the current leaving the +V terminal or entering the -V terminal, exceed the rated current for the given ambient temperature. Refer to SPECIFICATIONS AND FEATURES for current ratings.

FUSE SHUTDOWN

Fuses will blow when the maximum rated current value for the fuse is exceeded. Fatigue failure of fuses can occur when mechanical vibrations from the installation combine with thermally induced stresses to weaken the fuse metal. Many fuse failures are caused by a temporary condition and replacing the blown fuse will make the fuse protected circuit operative. When the LXD supply is used with the overvoltage protector option, fuses F1 and F2 will provide load protection against internal component failure.

TROUBLE SHOOTING CHART

	Symptom	Probable Cause	Remedy
1.	Zero volts DC output, both sides.	Short circuit across output of supply.	Check load and load connections, correct as necessary.
		F1, Q1 or R1 open.	Check F1, Q1 and R1 for open, replace as necessary.
		Shorted CR9 or C2.	Check CR9 and C2 for short, replace as necessary.
		IC1 defective.	Check pin 6 of IC1 (see schematic diagram) for indicated voltage. If indicated voltage is not present, replace IC1.
2.	Zero volts DC output, minus side.	F1, Q2 or R9 open.	Check F2, Q2, and R9 for open, replace as necessary.
		Short circuit across output of supply.	Check load and load connections, correct as necessary.
		Shorted CR10 or C4.	Check CR10 and C4 for short, replace as necessary.
		IC2 defective.	Check pin 6 of IC2 (see schematic diagram) for indicated voltage. If indicated voltage is not present, replace IC2.
3.	Unable to adjust output voltage.	Damaged VDC ADJ. control.	Check R6 for short and/or open, replace as necessary.
4.	High ripple at twice line frequency and unregulated DC output, both sides.	Q1 shorted.	Check Q1 for short, replace as necessary.
		Jumper between terminals 7 and 8 open.	Refer to figures 3 and 4 for proper supply terminal connections.

TROUBLE SHOOTING CHART (cont'd)

Symptom	Probable Cause	Remedy
5. High ripple at twice line frequency and unregulated DC output, minus side.	Q2 shorted.	Check Q2 for short, replace as necessary.
	Jumper between terminals 4 and 5 open.	Refer to figures 3 and 4 for proper supply terminal connections.
6. High ripple at line frequency, both sides.	Defective main rectifier, plus side.	Check for open and/or short CR1 thru CR4.
	C1 open.	Check C1 for open, replace as necessary.
7. High ripple at line frequency, minus side.	Defective main rectifier, minus side	Check for open and/or short CR5 — CR8.
	C3 open.	Check C3 for open, replace as necessary.
8. High ripple at frequency other than line or twice line frequency.	Oscillation due to defective component in filter network.	Check for open C5, C6, C2 and C4.

PERFORMANCE CHECKS

Check the ripple and regulation of the power supply using the test connection diagram shown in figure 6. Use suggested test equipment or equivalent to obtain accurate results. Refer to SPECIFICATIONS AND FEATURES for minimum performance standards.

Set the differential meter, DC VTVM (John Fluke Model 801H or equivalent) to the selected power supply operating voltage. Check the power supply load regulation accuracy while switching from the load to no-load condition. Long load leads should be a twisted pair to minimize AC pick-up.

Use a Variac to vary the line voltage from 105-132 or 132-105 volts AC and check the power-supply line regulation accuracy on the VTVM differential meter.

Use a VTVM, Ballantine 320 or equivalent, to measure rms ripple voltage of the power supply DC output. Use oscilloscope to measure peak-to-peak ripple voltage of the power supply DC output.

Perform checks on both plus and minus sides of the power supply.

SERVICE

When additional instructions are required or repair service is desired, contact the nearest office of the Lambda Electronics Corp. where trained personnel and complete facilities are ready to assist you.

Please include the power supply model and serial number together with complete details of the problem. On receipt of this information, Lambda will supply service data or advise shipping for factory repair service.

All repairs not covered by the warranty will be billed at cost and an estimate forwarded for approval before work is started.

PARTS ORDERING

Standard components and special components used in the Lambda power supply can be obtained from the factory. In case of emergency, critical spare parts are available through any Lambda office.

The following information must be included when ordering parts:

1. Model number and serial number of power supply and purchase date.
2. Lambda part number.
3. Description of part together with circuit designation.
4. If part is not an electronic part, or is not listed, provide a description function and location of the part.

PARTS LIST

The electrical parts located on Lambda model LXD-3-152 are listed here. In addition, there are separate listings of parts for the "V" option and MP-3, MP-5, P-3, and P-5 accessories

MODEL LXD-3-152

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.	UNIT PRICE
C1	Cap., elect., 400 mf -10 +100%, 40 vdc	CBR-40-085	$ 3.50
C2	Cap., elect., 50 mf, -10 +75%, 50 vdc	CBP-50-058	.51
C3	Same as C1		
C4	Same as C2		
C5, C6	Cap., mylar, 0.01 mf, ±10%, 400 vdc	CGL-10-002	.36
C7	Cap., mylar, 0.033 mf ±10%, 400 vdc	CGL-33-009	.50
C8	Cap., tant., 1 mf ±20%, 35 vdc	CBN-10-009	1.33
CR1 thru CR10	Rectifier	FBL-00-030	1.40
CR11	Rectifier, zener diode	FBM-Z104	.75
CR12, CR13	Same as CR1		
IC1, IC2	Integrated circuit	FBT-00-016	3.00
Q1, Q2	Transistor, NPN	FBN-36485	4.13
R1	Res., w.w., 0.91 ohm ±5%, 2w	DLM-91-006	1.32
R2	Res., comp., 470 ohms ±10%, ¼ w	DCB-4711	.10
R3	Not assigned		
R4	Res., film, 680 ohms ± 2%, ¼ w	DCR-68-073	.15
R5	Not assigned		
R6	Res., variable, cermet, 2,000 ohms, ±10%, 1 w	DRS-20-012	1.83
R7	Not assigned		
R8	Res., film, 1,200 ohms ±5%, ¼ w	DCS-12-085	.15
R9	Same as R1		
R10	Same as R2		
R11	Not assigned		
R12	Res., film, 3,160 ohms ±0.5%, ¼ w	DCS-32-082	.33
R13	Not assigned		
R14	Res., film, 8,870 ohms ±0.5%, ¼ w	DCS-89-090	.33
R15	Not assigned		
R16, R17	Res., film, 2,550 ohms ±0.5%, ¼ w	DCS-25-089	.33
R18	Same as R8.		
R19	Same as R2.		
T1	Transformer	ABA-LXD3-152	16.02

PARTS FOR "V" OPTION

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.	UNIT PRICE
	On model LXD-3-152 with suffix "V" capacitor C7 and transformer T1 change. Part no. changes for C7 and T1 are listed here.		
C7	Cap., mylar, 0.01 mf ±10%, 600 vdc	CGL-10-010	$ .50
T1*	Transformer	ABA-LXD-3-152G	16.02

* On units with serial no. prefix A, T1 is ABA-LXD-3-152V.

PARTS FOR OVER VOLTAGE ACCESSORY MODEL LCOV-11

C1	Cap., mylar, 0.01 mf ±20%, 80 vdc	CGL-10-008	.50
Q1	Transistor, NPN	FBN-L102	2.40
Q2	Transistor, PNP	FBN-L114	3.50
R1	Res., var., w w, 20,000 ohms ±10%, 1 w	DNT-20-010	2.85
R2	Res., film, 560 ohms ± 2% ¼ w	DCR-56-035	.30
R3	Res., film, 200 ohms, ±5%, ¼ w	DCR-20-036	.30
R4	Res., thermistor, 425 ohms ±5%, 1¼ w	DKR-43-004	1.35
R5, R6	Res., comp., 1,200 ohms ±10%, ¼ w	DCB-1221	.10
R7	Res., comp., 33 ohms ±5%, ¼ w	DCB-3305	.15
R8	Res., comp., 15,000 ohms, ±10%, ¼ w	DCB-1531	.12
R9	Res., comp., 27 ohms, ±10%, ¼ w	DCB-2701	.10
R10	Same as R5		
SCR1	Rectifier, silicon controlled	FBP-00-014	3.00

PARTS FOR METERED AND NON-METERED PANEL ACCESSORIES MODELS MP-3, MP-5, P-3, P-5

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.	UNIT PRICE
C1, C2	Cap., tant., 2.5 mf -15+75%, 100 vdc	CBN-25-010	$ 1.80
DS1	Pilot light assembly	HRD-00-007	.83
F1	Fuse, 1A,3AG, SLO-BLO	FFC-01-000	.75
M1*	Voltmeter, 0-40 vdc	EBP-40-013	16.45
M2*	Ammeter, 0-1 adc	EDN-10-014	12.00
S1**	Switch, SPST	FDA-11-001	.94
S1†	Switch, SPST	FDA-11-040	2.22
XF1	Fuseholder	HRK-00-007	1.60

*This part only used on MP-3, MP-5.
**This part only used on MP-3, P-3.
†This part only used on MP-5, P-5.

PARTS FOR METERED AND NON-METERED PANEL ACCESSORIES WITH "V" OPTION

CIRC. DESIG.	DESCRIPTION	LAMBDA NO.	UNIT PRICE
	On all metered and non-metered panels with suffix "V", Fuse F1 changes and a resistor is added in series with pilot light DS1. Part nos. for F1 and DS1 -Res. are listed here		
F1	Fuse, 0.5A, 3AG, SLO-BLO	FFC-00-500	$1.05
DS1-Res.	Res., comp., 120,000 ohms ±10%, ½ w	DEB-1241	.12

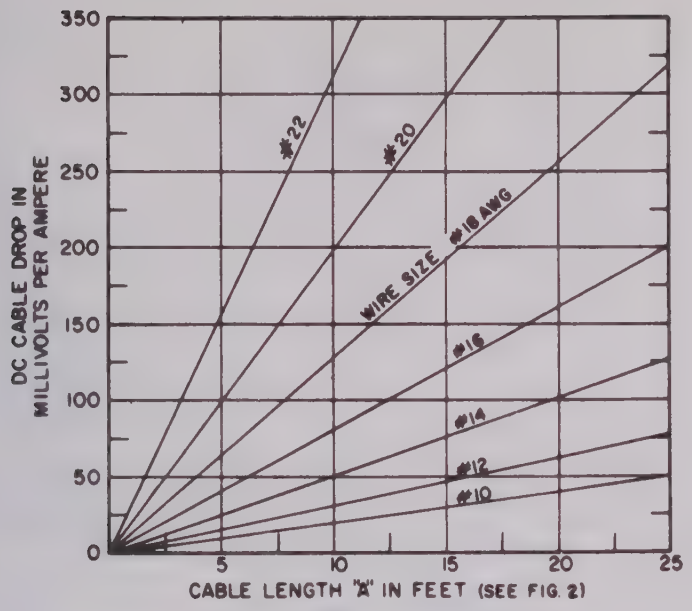


Figure 1. Cable Connection Chart

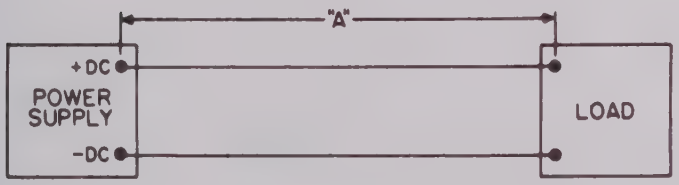


Figure 2. Cable Length "A" in Feet

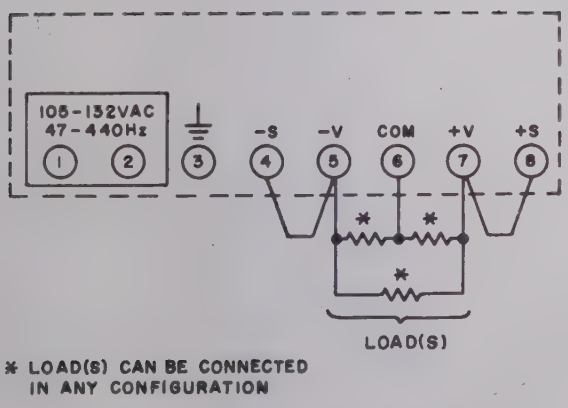


Figure 3. Local Sensing Connection

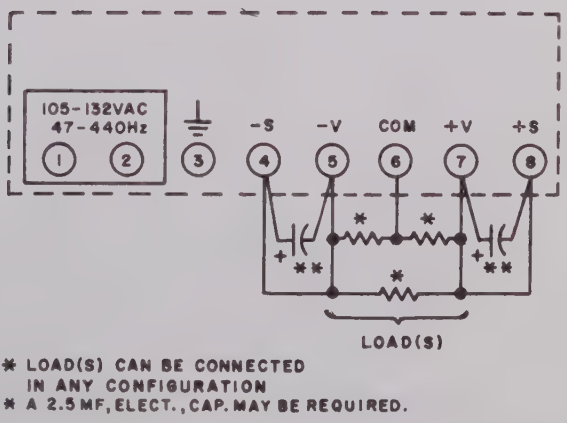


Figure 4. Remote Sensing Connection

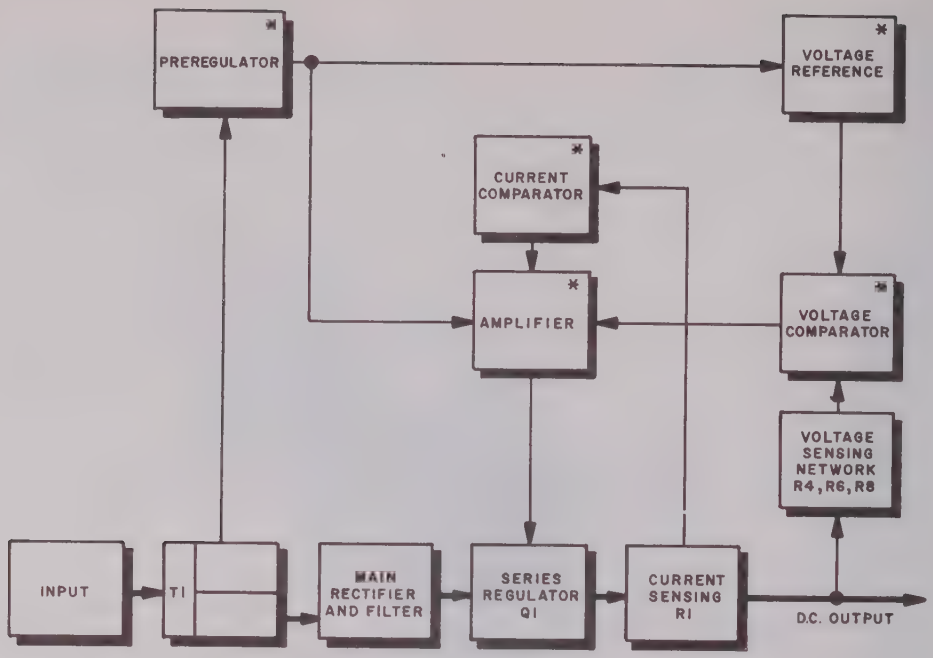

PREREGULATOR
VOLTAGE REFERENCE
CURRENT COMPARATOR
AMPLIFIER
VOLTAGE COMPARATOR
VOLTAGE SENSING NETWORK R4, R6, R8
INPUT
T1
MAIN RECTIFIER AND FILTER
SERIES REGULATOR Q1
CURRENT SENSING R1
D.C. OUTPUT
NOTE: THIS DIAGRAM APPLIES TO (+) SIDE OF POWER SUPPLY BUT CAN BE USED FOR (−) SIDE BY SUBSTITUTING THE CORRESPONDING COMPONENT CIRCUIT DESIGNATIONS.
* THIS CIRCUIT ELEMENT IS LOCATED IN IC1.

Figure 5. Block Diagram

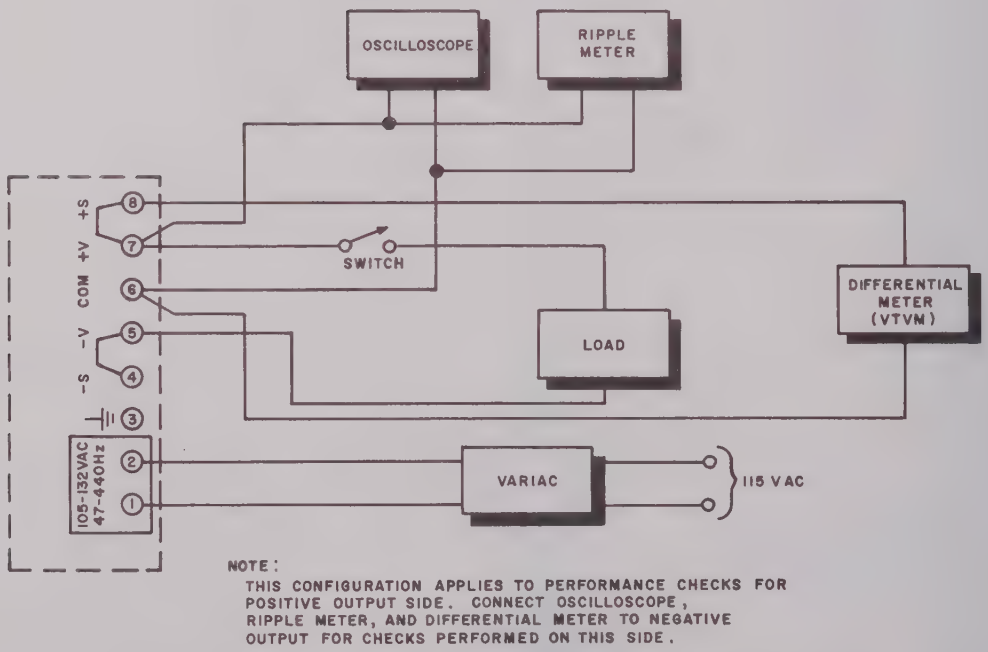


Figure 6. Test Connections For Performance Checks.

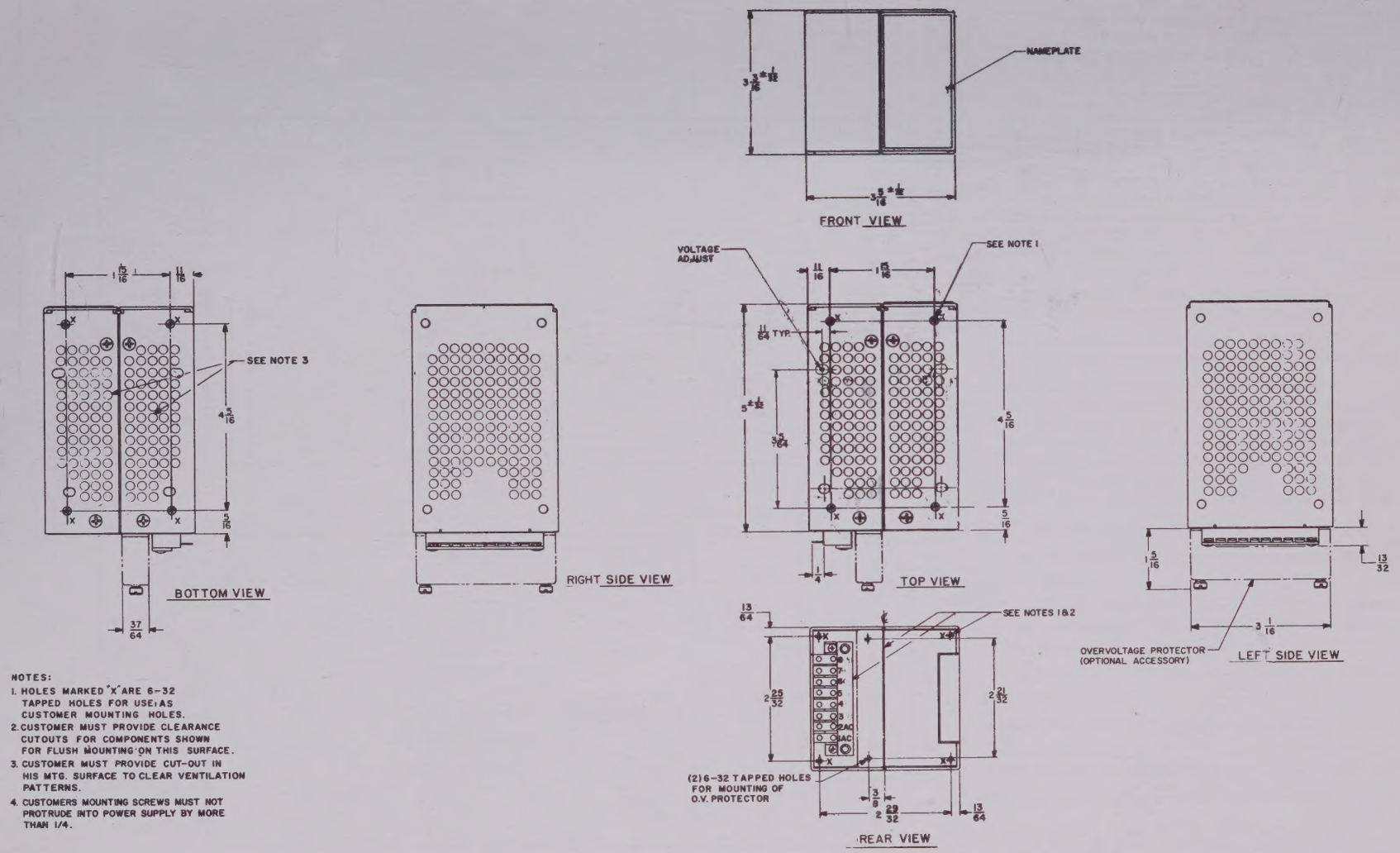
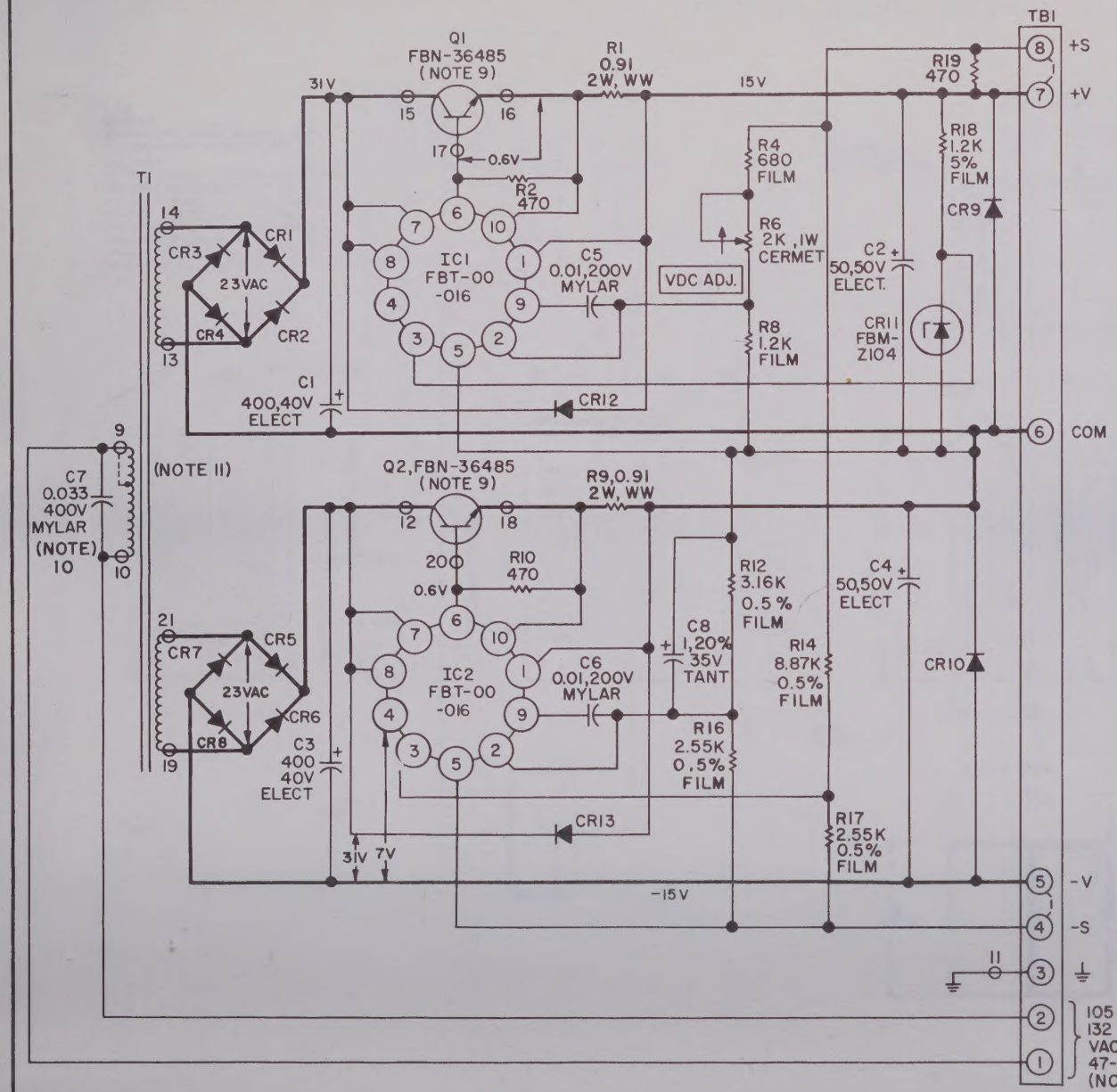

NAMEPLATE
FRONT VIEW
SEE NOTE 3
BOTTOM VIEW
RIGHT SIDE VIEW
VOLTAGE ADJUST
SEE NOTE 1
TOP VIEW
OVERVOLTAGE PROTECTOR (OPTIONAL ACCESSORY)
LEFT SIDE VIEW
SEE NOTES 1&2
(2) 6-32 TAPPED HOLES FOR MOUNTING OF O.V. PROTECTOR
REAR VIEW
NOTES:
1. HOLES MARKED "X" ARE 6-32 TAPPED HOLES FOR USE AS CUSTOMER MOUNTING HOLES.
2. CUSTOMER MUST PROVIDE CLEARANCE CUTOUTS FOR COMPONENTS SHOWN FOR FLUSH MOUNTING ON THIS SURFACE.
3. CUSTOMER MUST PROVIDE CUT-OUT IN HIS MTG. SURFACE TO CLEAR VENTILATION PATTERNS.
4. CUSTOMERS MOUNTING SCREWS MUST NOT PROTRUDE INTO POWER SUPPLY BY MORE THAN 1/4.

Figure 7. Outline Drawing



NOTES:

1. RESISTORS ARE COMP. 1/4W WITH VALUES IN OHMS, UNLESS OTHERWISE NOTED.
2. RESISTOR TOLERANCES: COMP. ±10%, FILM ±1%, WIREWOUND ±5%, UNLESS OTHERWISE NOTED.
3. CAPACITOR VALUES ARE IN MICROFARADS.
4. CAPACITOR TOLERANCES: MYLAR ±10%, ELECTROLYTIC -10 +100%.
5. DESIGNATIONS ARE LAMBDA PART NUMBERS.
6. SYMBOLS:
   - INDICATES CLOCKWISE ROTATION OF SHAFT.
   - INDICATES CONNECTION TO CHASSIS.
   - LAMBDA PART NO. FBL-00-030; USE IN4002 DIODE FOR REPLACEMENT UNLESS OTHERWISE NOTED.
   - INDICATES TERMINAL ON PRINTED CIRCUIT BOARD.
   - INDICATES ACTUAL UNIT MARKING.
7. CONDITIONS FOR CIRCUIT POINT MEASUREMENTS: INPUT: 115 VAC, 60Hz. MAX. RATED VOLTAGE NO LOAD. INDICATED VOLTAGES ARE TYPICAL VALUES AND ARE D.C. UNLESS OTHERWISE NOTED, D.C. MEASUREMENTS TAKEN WITH 20,000 OHMS/V VOLTMETER BETWEEN COM. (TERM 6) AND INDICATED POINTS UNLESS OTHERWISE NOTED.
8. DELETE 40°C RATING FOR 47-57Hz INPUT, FOR 63-440Hz INPUT CONSULT FACTORY.
9. COAT BOTH SIDES OF INSULATING WAFER WITH DOW CORNING NO. 340 SILICONE GREASE.
10. C7 IS 0.01 MF 600V ON UNITS WITH "V" OPTION.
11. ON UNITS WITH "V" OPTION, T1 HAS TAPPED PRIM. "V" OPTION UNITS CAN BE WIRED FOR 187-242V INPUT (USING TAP), OR FOR 205-265V INPUT (USING ENTIRE PRIMARY). ON SERIAL NO. PREFIX A, "V" OPTION UNITS; T1 PRIMARY IS NOT TAPPED. AC INPUT IS 205-265V.

FOR WIRING OF POWER SUPPLY TO LOAD REFER TO SUPPY-TO-LOAD WIRING DIAGRAMS.
DOTTED CONNECTIONS SHOWN ON TB1 INDICATE JUMPERS IN PLACE FOR LOCAL SENSING CONNECTION.

THIS SCHEMATIC APPLIES TO UNITS BEARING SERIAL NO. PREFIXES A & B

SCHEMATIC DIAGRAM
REGULATED POWER SUPPLY
LXD-3-152

LAMBDA ELECTRONICS CORP.
MELVILLE, NEW YORK
A Veeco SUBSIDIARY

5-Year
Guarantee
We warrant each instrument manufactured by us, and sold by us or our authorized agents, to be free from defects in material and workmanship, and that it will perform within applicable specifications for a period of five years after original shipment. Our obligation under this guarantee is limited to repairing or replacing any instrument or part thereof, (except tubes and fuses) which shall, within five years after delivery to the original purchaser, be returned to us with transportation charges prepaid, prove after our examination to be thus defective.
We reserve the right to discontinue instruments without notice, and to make modifications in design at any time without incurring any obligation to make such modifications to instruments previously sold.

LAMBDA ELECTRONICS
515 BROAD HOLLOW ROAD • MELVILLE, L. I., NEW YORK • 516 MYRTLE 4-4200

DIVISION of Veeco INSTRUMENTS INC.

MP MASTER
MA28944